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DEFINITIONS AND CRITERIA OF PREDATORY PRICING

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Definitions and criteria of predatory pricing*

David Spector (MIT)†

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Abstract

This paper is an attempt to clarify the definition of predatory pricing, and to compare various legal criteria for the investigation of predation claims. By constructing a simple but full-fledged model, I show that (i) several definitions of what constitutes predatory pricing, often considered as equivalent, are in fact different; and (ii) the existing justifications for the use of price-cost comparisons (the Areeda-Turner test and its variants) are logically flawed. Other proposed rules, such as Williamson's output restriction rule or Baumol's "permanence of price reduction" rule are also problematic if courts hesitate between viewing a particular market as characterized by competition in prices or by competition in quantities. These remarks lend support to the use of two-tier procedures such as the one advocated by Joskow and Klevorick, and, more generally, lead us to view the rule of reason as superior to any per se rule.

I- INTRODUCTION

The goal of this paper is to contribute to the clarification of some of the most fundamental questions regarding the issue of predatory pricing. It deals primarily with two points: the definition itself, and the relevance

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of price-cost comparisons as tests of predatory pricing. Using a simple but full-fledged model, I show that (i) several definitions of what constitutes predatory pricing, often considered as equivalent, are in fact different; and (ii) the existing justifications for the use of price-cost comparisons (the Areeda-Turner test and its variants) are logically flawed. In addition, I provide support for one of the definitions of predation (very close to Ordover and Willig's [1981]), and I discuss various criteria proposed in the literature for courts to assess predation claims.

To the extent that economic concepts often cannot be used as such in judicial proceedings (for example because they refer to counterfactuals, such as determining whether an alleged predator's actual action would have been the most profitable one if there were no barriers to entry, when in fact there are), they find their way into courts only indirectly, through the use of more workable criteria. Accordingly, in the case of predatory pricing, a large body of literature has focussed not on the issue of the definition itself, but on the more pragmatic search for legal criteria which would allow courts to approximate the "true" definition. In the course of the debates stimulated by Areeda and Turner's [1975] seminal paper, which proposed a price-cost comparison still widely used in courts, many criteria were put forward, such as Posner's [1976] "marginal cost plus intent" test, Williamson's [1977] output restriction rule, Joskow and Klevorick's [1979] two-tier mechanism, or Baumol's [1979] "quasi-permanence of price reductions" rule.

Since then, owing to the advances of game theory, economists' understanding of predatory behavior tremendously improved. New analytical tools have allowed them to shed light on the weaknesses of McGee's [1958] influential argument that predatory behavior is likely to be rare. It was shown indeed that in the presence of asymmetric information (about market conditions, costs, "taste" for predation, or simply other firms' strategies), or of financial market imperfections, predation is theoretically possible, without even requiring the kind of barriers to entry which were traditionally thought to be a necessary condition[1].

According to Klevorick [1993] and Bolton et al. [2000], courts failed to integrate the theoretical developments which occurred in the preceding two decades[2], and the main task economic and legal experts should undertake

[1]For a survey of these theories, see Ordover and Saloner [1989] and Milgrom and Roberts [1990]. In the decade since these surveys were written, the most striking theoretical development was Roth [1996], although it probably has little empirical relevance.

[2]Klevorick [1993] writes: "Where in all of the judiciary's elaboration of the law of

consists in designing workable rules which would take the new economic knowledge into account (Bolton et al. [2000] impressively set themselves to this task).

Why, then, go back to such basic issues as the definition of predation and price-cost comparisons, if the task ahead is rather to incorporate sophisticated economic theory into legal practice? First, any analysis of predation, theoretical or empirical, would gain if the confusion and imprecision surrounding definitions were dissipated. Besides this obvious point, a more practical reason makes the question of definition one of paramount importance. If any conclusion is to be reached from the vast economic literature about predation, it is that no single rule or procedure, however complex, can encompass the variety of situations identified by Industrial Organization theory as potentially conducive to predatory behavior. This led some skeptical authors (such as Phlips, 1996) to advocate the use of a rule of reason as superior to any per se rule. While the use of a per se rule makes the legal criterion central, and the underlying economic definition marginal, the rule of reason has the opposite effect, and makes it necessary to clarify the definition of predation.

Regarding price-cost comparisons, one must recognize that the evolution of academic literature (Joskow and Klevorick, 1979) and of legal practice (culminating in the Supreme Court's opinion in *Brooke Group Ltd. v. Brown and Williamson Tobacco Corp.*, 509 U.S. 209, 1993), with its increased focus on investigating the possibility for an alleged predator to later recoup the losses sustained during the predation period, made the Areeda-Turner test less central than its proponents had initially advocated[3]. But it continued to play an important role: Joskow and Klevorick [1979] themselves support its use in the second tier of the mechanism they propose, and courts still heavily rely on it, keeping the debate about its technical aspects lively (Baumol, 1996). Understanding the logic of price-cost comparisons, and their weaknesses, is therefore directly relevant for policy.

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predatory pricing are the insights of the market organization literature on predation? Nowhere." Bolton et al. [2000] concur, claiming that "the courts [...] have failed to incorporate the modern writing into judicial decisions, relying instead on earlier theories which are no longer generally accepted."

[3]This qualification does not apply to Europe, where the Areeda-Turner test remains unchallenged.

Approach of this paper

The novelty of this paper is methodological: in contrast with most of the legal literature (or the "law and economics" literature) about predation, I discuss legal definitions and criteria through the use of a complete formal model. Indeed, while the theoretical literature mentioned above developed sophisticated modelling techniques and was characterized by an ever increasing level of logical rigor, the legal literature about predation (most of which dates back to the late 1970s and early 1980s) is written in an informal or half-formal style. More precisely, it often relies, implicitly or explicitly, on a very crude view of price competition, leading to deceptively simple arguments which are not always free of inconsistencies. This is not surprising, since, as Scherer [1976a] writes, "prose is a poor substitute for the rigorous application of price theory".

For example, the use of price-cost comparisons is often justified through a reasoning along the following lines: if a firm prices over its average cost, then it does not prevent an equally or more efficient firm from entering into the market because any more efficient firm could, by offering a slightly lower price, serve the whole market while earning positive profits. Conversely, pricing below average variable cost must be predatory, because it is unprofitable unless it is part of a strategy leading to higher prices later. The implicit underlying assumption is that firms produce the same good and compete in prices. But this assumption is very disputable. It implies indeed that in a normal situation where both firms compete fairly, prices equal marginal costs. Not only is this typically not true in very concentrated industries (which are precisely the ones where predation claims arise), but the equality of prices and marginal costs also raises theoretical problems, because it implies that a duopoly is not viable if firms' technologies are characterized by a fixed cost and a constant marginal cost. In other words, the view of the world implicit in many arguments found in the legal literature about predation is incompatible with the description of an equilibrium under "fair competition".

Given such difficulties, it is necessary to a conduct a more formal investigation, with the goal of analyzing "fair competition" and predatory pricing within a unified model. This is the approach followed in this paper, which is organized as follows. First, several frequent definitions of predatory pricing are presented (section II). In section III, I discuss the properties a formal model of predatory pricing should have, and I present such a model, which is then applied to the comparison of the different definitions. In section IV, the

model is used to assess the various criteria proposed in the literature, with a particular emphasis on the Areeda-Turner test. Finally, the robustness of the conclusions to alternative assumptions is discussed (Section V).

II - THREE DEFINITIONS OFTEN (AND WRONGLY) HELD AS EQUIVALENT

While the definitions proposed in the legal literature vary in many details, they share a common underlying idea of what constitutes predatory pricing, which can be summarized as follows:

"1. An action is predatory if (i) it is not the most profitable action unless its effects on other firms' entry or exit decisions are taken into account.

2. *This condition can be met only if. (ii) thanks to the induced exit or absence of entry, the alleged predator enjoys an increased market power which allows it to later raise its price to supracompetitive levels.*

3. *Only if these conditions are met can a firm exclude an equally efficient or more efficient competitor."*

I will show below that sentences 2 and 3 are wrong. In other words, it is possible for condition (i) to be met while (ii) is not satisfied, and a firm can exclude an equally efficient competitor without condition (i) being satisfied. Wrongly believing that these two sentences are true led many authors to indifferently propose the three definitions below, held as equivalent when in fact they are not.

D1. An action is predatory if condition (i) is satisfied.

D2. An action is predatory if condition (i) is satisfied, AND if the ability to later reverse the action which caused the other firms to exit or not to not enter, i.e. the ability to later raise prices or decrease output, is necessary to make the action profitable.

D3. An action is predatory if it induces the exclusion or prevents the entry of an equally efficient or more efficient rival.

For example, Baumol [1996] adopts these three definitions within an interval of five pages, without anywhere hinting at the slightest discrepancy among them. He writes indeed (p. 50) that "a proper [...] price is one that does not threaten the existence (or at least the presence) of any equally efficient or more efficient supplier", which coincides with D3. But on page 52, he states that for a price to be predatory, "there must be a reasonable prospect of recoupment of at least whatever initial costs [...] were entailed in the company's adoption of the price in question, that recoupment taking the form of monopoly profits made possible by reduction (as a result of [the price]) in the number of competitors" (this is D2). Finally, on page 55, he explains that "an act by a firm [has] a legitimate business purpose if it promises to yield a net addition to the firm's profits over the long-run, a profit that does not depend on the exit of any at least equally efficient rivals or on prevention of entry of efficient firms" (this is almost D1, formulated here through the definition of what constitutes a non-predatory act).

A comparison of the most influential contributions about predation since Areeda and Turner's [1975] seminal work reveals a similar lack of agreement on a single definition, and, more strikingly, the absence of any awareness of this lack. For example, D3 is adopted by Areeda and Turner [1975] and Posner [1976], D2 by Ordover and Willig[4] [1981] and Joskow and Klevorick[5] [1979], while other authors oscillate between D1 and D2, such as Baumol[6] [1979] and Bolton et al.[7] [2000]. Phlips' [1988,1996] stance is different from

[4] "A practice [...] is predatory only if the practice would not be profitable without the additional monopoly power resulting from the exit."

[5] "Predatory pricing behavior involves a reduction of price in the short run so as to drive competing firms out of the market or to discourage entry of new firms in an effort to gain larger profits via higher prices in the long run than would have been earned if the price reduction had not occurred."

[6] Baumol [1979] writes that "any reduction in price, or any other decision, should be judged non-predatory if and only if it is profitable for the incumbent on the assumption either that the entrant is there to stay indefinitely or that the probability that the entrant will withdraw is fixed" (footnote 50, p. 26). But in the abstract of the same paper, he writes that "pricing is predatory only where the firm foregoes short-term profits in order to develop a market position such that the firm can later raise prices and recoup lost profits."

[7] "A predatory price is a price that is profit-maximizing only because of its exclusionary or other anticompetitive effects. The anticompetitive effects of predatory pricing are higher prices and reduced output [...] achieved through the exclusion of a rival or potential rival." Later, the authors claim that the only possible way for the exclusion of a rival to be profitable is if it allows the alleged predator to raise prices: "Proof of recoupment requires [...] proof that the predator will be able to raise price above the competitive level. [...]

all the ones mentioned above, since he defines "predation as a pricing policy that turns a profitable entry opportunity for an entrant [in a noncooperative post-entry Nash equilibrium] into an unprofitable one".

Courts' opinions are no less varied (Klevorick, 1993; Bolton et al., 2000). Given the general agreement that they lag the developments of economic research by at least two decades, I feel no need to review them here. Indeed, this consensus implies that the important task in the debate about predation is to clarify academic thinking as much as possible in order to facilitate its incorporation into legal practice, rather than to stress the inconsistencies of recent courts' opinions, which are already the focus of much criticism.

III - ANALYSIS OF THE THREE DEFINITIONS WITHIN A SIMPLE MODEL

The reason why definitions D1 and D2 above are in fact not equivalent can be explained simply and informally. When a firm is driven out of a market, the demand for the goods supplied by the firms remaining in the market increases, because consumers who otherwise would have bought its product no longer can, and some of them choose to buy from the remaining firms instead. This increase in demand may be enough to make a rival's exclusion profitable *without any need to raise price.* A price which is low enough to be suboptimal for the alleged predator assuming the alleged prey stays in the market, but which is optimal if it induces the alleged prey's exit without requiring a subsequent price rise, is predatory according to definition D1, but not according to definition D2.

Similarly, if firms' strategic decisions are quantities rather than prices, a quantity increase by firm A may not be optimal assuming the other firm (firm B) responds by choosing the optimal quantity *conditional on not exiting*, but may be optimal because it induces firm B to exit, and therefore causes the price faced by firm A to rise, without requiring firm A to decrease its output level after firm B exited[8].

Analyzing a full-fledged model can help to clarify these points. As Schmalensee [1979] and Fisher [1989] convincingly argue, the broad variety of Industrial

Put simply, recoupment requires a showing that the predatory conduct will be profitable."

[8]These points are by no means new: they are at the core of the theory of limit pricing, which goes back to the 1950s (Bain, 1956; Modigliani, 1958). The novelty comes from taking them into account in a discussion of legal definitions and criteria of predation.

Organization theory makes it easy to reach any particular conclusion and to misrepresent it as a general truth by carefully selecting a model. This should generate skepticism regarding overly confident interpretations of results found in any particular model. In order to take these criticisms into account, the model should be kept simple, every assumption should be justified, and the sensitivity of the results to the specifics of the model should be discussed.

What is required of a model of price competition in order to think about predation, and, more precisely, about the three definitions presented above? The simplest model should describe the interplay of two firms, which can be summarized, on the production side, by the firms' cost functions, and, on the demand side, by the demand function faced by each firm as a function of both firms' prices.

For the sake of tractability, it is convenient to assume marginal costs to be constant. At the core of the theory of predation is the idea that a firm may choose to exit from a market in order to avoid the losses it would incur if it stayed in the market. But a firm can make losses only if it bears fixed costs of production. Indeed, absent any fixed costs, a firm can always set a price above its marginal cost, which yields a nonnegative profit (at worst, a zero profit). Similarly, for exit to be a way of avoiding these losses, it must be the case that exiting from the market (i.e. producing nothing) is enough to get rid of the fixed cost, which means that the fixed cost is not a sunk cost. I will therefore describe the production side of the economy by assuming each firm's technology to be characterized by a constant marginal cost and a fixed cost which is not sunk[9]. For analytical simplicity, I will assume both firms' marginal costs to be constant. This leaves the possibility of assuming different fixed costs, which will allow us to consider firms with different levels of efficiency.

How should the demand side of the economy be modelled? I assume both firms to produce different goods rather than the same good. This modelling

[9]For a thorough discussion of the concepts of fixed versus sunk costs, see Baumol and Willig [1981]. In the model developed below, the important assumption is that the fixed cost is not sunk in the long-run, although it may be in the short-run. For example, if the good is movie projections, the fixed cost is the rent of the theater, which does not depend on the number of tickets sold. It is sunk in the short-run because the firm may be bound to pay the rent until the current lease expires, but not in the long-run in the sense that, periodically, a firm can decide whether to continue to pay this cost or not (to renew the lease or not).

choice can be justified on empirical and theoretical grounds. Obviously, it fits reality better, since different firms rarely sell perfect substitutes. But this argument alone is not sufficient, because theorists generally allow themselves vast departures away from realism for the sake of simplification. The theoretical reason is more fundamental. Predatory pricing is usually analyzed against a competitive benchmark, and a satisfactory model should allow for the possibility of a competitive equilibrium where both firms are present and make nonnegative profits. But if both firms produce the same good, then the outcome of price competition is such that the price is equal to both firms' marginal costs (assumed to be identical), leading both firms to earn negative profits, because the revenue from sales is just enough to cover the variable cost, but not the fixed cost. Therefore, product heterogeneity is necessary for a competitive equilibrium to exist where both firms are active. In other words, product heterogeneity implies that each firm has some market power, which leads to prices above marginal costs in equilibrium, and therefore, possibly, to positive profits. Once product heterogeneity is justified, the choice of a specific demand function remains. For analytical tractability, I will assume linear demand.

This discussion leads to the following model[10].

Production

Both firms' face the same constant marginal cost of production, c. In addition, firm i (i=1 or 2) faces a fixed cost F_i, so that firm i's cost function is given by

$$c_i(y) = cy + F_i.$$

Demand

As long as both firms' prices p_1 and p_2 are neither too large nor too far away from each other, the demand for each firm's product is given by

$$\begin{aligned} q_1 &= \frac{1}{2} + \frac{p_2 - p_1}{2\alpha}, \\ q_2 &= \frac{1}{2} + \frac{p_1 - p_2}{2\alpha}. \end{aligned}$$

[10] It is simply a version of Salop's [1979] classical model. The only difference is that, unlike Salop, who assumes free entry in order to endogenize the number of firms, I assume there to be two firms.

These linear demand functions, very frequent in the literature, arise for example if product differentiation is modeled in terms of transportation costs, following Salop [1979]: the two firms can be viewed as selling the same good at opposite extremities of a straight line, with a distance of 1 between them, assuming that a mass 1 of consumers are located evenly on the straight line, face a transportation cost α per unit of distance, and have unit demand with a large valuation. α is an inverse measure of how closely substitutable the two goods are: the larger α is, the less substitutable they are, the less competitive the market is, and the larger profits are.

Best responses

The study of exclusionary prices as well as of competitive equilibria relies on answering the following question: given a firm's price, what is the other firm's optimal price (or "best response"). The simplicity of the cost and demand functions assumed above makes answering this question easy (I do not take into account, at the moment, the possibility for a firm to produce nothing, i.e. to exit from the market). Firm i's profit is the revenue from its sales minus its production costs, or (writing firm j for the firm other than firm i)

$$\pi_i(p_1, p_2) = (p_i - c)\left(\frac{1}{2} + \frac{p_j - p_i}{2\alpha}\right) - F_i.$$

Given the value of p_j, this expression is maximized by setting p_i at the level $P_i(p_j)$, given by

$$P_i(p_j) = \frac{p_j + c + \alpha}{2}. \qquad (\mathrm{BR}_i)$$

$P_i(p_j)$ is firm i's best response, conditional on not exiting, to firm j setting the price p_j.

Nash equilibrium

The Nash equilibrium is the outcome arising if each firm takes the other firm's price as given, and sets its own price in order to maximize its profit (such behavior is the opposite of the behavior of an alleged predator, which is supposed to take into account the effect of its action on the other firm's action, more precisely on the other firm's decision to exit). It can be found,

therefore, by writing that each firm's price is the best response to the other firm's price, or, using the identities (BR_1) and (BR_2), by solving the equations $P_i(P_j(p_i)) = p_i$ and $P_j(P_i(p_j)) = p_j$, which yields the equilibrium prices p_1^* and p_2^* given by

$$p_1^* = p_2^* = c + \alpha.$$

In equilibrium, prices are equal, so the demand functions assumed above imply that each firm sells a quantity of $\frac{1}{2}$, and firm i's profit is equal to

$$\pi_i^* = \frac{1}{2}(p_i^* - c) - F_i = \frac{\alpha}{2} - F_i. \tag{1}$$

For both firms to be present in equilibrium, profits must be positive, or

$$\alpha \geq 2Max(F_1, F_2). \tag{\textbf{A1}}$$

This condition is very intuitive: for revenues to cover fixed costs and profits to be positive, the intensity of competition must be low enough (i.e. product differentiation, measured by the parameter α, must be large enough relative to fixed costs). I assume throughout the paper that (A1) is satisfied.

Exclusionary prices

Let p_1^{pred} denote the highest price that firm 1 can charge while inducing firm 2 to earn negative profits if present in the market. Firm 2's best response, given by (BR_2), together with the demand equations, implies that firm 2's profit as a function of firm 1's price is given by

$$\pi_2(p_1) = \frac{(p_1 + \alpha - c)^2}{8\alpha} - F_2.$$

Therefore, p_1^{pred}, defined by the equation $\pi_2(p_1^{pred}) = 0$, is equal to

$$p_1^{pred} = c - \alpha + (8\alpha F_2)^{1/2}. \tag{2}$$

(A1) implies, of course, that this price is less than the price prevailing in the initial equilibrium. Clearly, firm 1's profit when charging p_1^{pred} is lower than its equilibrium profit if firm 2 does not exit. What is its post-predation profit after firm 2' exit? I investigate the case where firm 1 cannot raise its price after firm 2's exit, either because such a price increase is forbidden by

the law, or because it would trigger firm 2's immediate re-entry. Then, in order to keep firm 2 out of the market, firm 1 must continue to charge the price p_1^{pred}. But after firm 2's exit, it sells to all consumers (they have no choice any more, and must all buy from firm 1), and firm 1's post-predation profit is equal to revenue minus cost, or

$$\pi_1^{pred} = 1.(p_1^{pred} - c) - F_1 = (8\alpha F_2)^{1/2} - \alpha - F_1. \tag{3}$$

For firm 1 to find it profitable to exclude firm 2 from the market without later increasing its price, the induced profit, after firm 2's exclusion, must exceed the profit that prevailed in the competitive equilibrium. In other words, exclusion without a subsequent price rise is profitable if $\pi_1^{pred} > \pi_1^*$. Substituting the expressions found for π_1^{pred} and π_1^* ((1) and (3)) yields the following result after rearranging terms:

RESULT 1. *If $\alpha < \frac{32}{9}F_2 \approx 3.6F_2$, then it is profitable for firm 1 to drive firm 2 out of the market by decreasing its price from p_1^* to p_1^{pred}, even if firm 1 cannot raise its price later.*

Remarks.

1. This result is enough to show that propositions 2 and 3 above are wrong, and that definitions D1, D2, and D3 do not coincide. Indeed, the inequality $\frac{32}{9} > 2$ implies that the condition of Result 1 can be met: if α belongs to the interval $(2F_2, 3.6F_2)$, and $\alpha \geq 2F_1$, (A1) is satisfied, and excluding firm 2 by offering low prices is profitable for firm 1 even without a subsequent price rise. This means that sentence 2 is wrong, and that definition D2 is strictly narrower than D1: if $\alpha \in (2F_2, 3.6F_2)$ and $\alpha \geq 2F_1$, then a decrease of firm 1's price from p_1^* *to* p_1^{pred}, which drives firm 2 out of the market, is predatory according to D1 but not to D2, because subsequent higher prices are not needed to make firm 2's exclusion profitable for firm 1.

2. If in addition $F_1 \geq F_2$, then firm 1 excludes from the market a rival which is at least as efficient, and the price decrease is also predatory according to D3. Therefore, D3 may be satisfied while D2 is not, and D2 is also strictly narrower than D3 (this comparison assumed that the behavior under scrutiny is optimal for firm 1, which is not part of definition D3, but this assumption is very weak because it is natural to assume firms to maximize profits).

3. Since the conditions $\alpha \in (2F_2, 3.6F_2)$ and $\alpha \geq 2F_1$ are compatible with firm 1 being more efficient than firm 2 ($F_1 < F_2$), D1 can be satisfied while D3 is not. The reason why the exclusion of a less efficient competitor may be predatory according to D1 is that, because of product differentiation and of the market power this induces, it is possible for two firms of unequal efficiency to be present in the market in a competitive equilibrium, and exclusion of the less efficient one, which by definition is not predatory according to D3, may be predatory according to D1.

4. The key idea behind these remarks - in the presence of fixed costs, exclusion of an equally efficient firm may be profitable without a subsequent price rise - is unrelated to the specifics of the model, and their validity is therefore quite general.

Which definition is best?

As the above discussion shows, D1, D2, and D3 are not equivalent. In order to determine which one is best, the most natural approach is to assess the welfare consequences of the actions each of them would allow or forbid[11].

The model's simplicity makes it easy to calculate the welfare consequences of a firm's exit. Since we are concerned only with overall welfare, and not with the distribution of the economic surplus between consumers and firms, prices matter only to the extent that they affect quantities, or exit decisions.

A priori, the welfare effect of a firm's exit is ambiguous. On the one hand, exit reduces product diversity, which is bad. On the other hand, the presence of two firms rather than one implies that the fixed cost of production is duplicated, which may be socially wasteful, and excluding a firm may be good to the extent that it removes this duplication. More precisely, if firm 2 exits, the fixed cost F_2 is saved, but the average transportation cost rises by $\alpha/4$, from $\alpha/4$ to $\alpha/2$ (the expression "transportation costs" is used because the spatial metaphor makes the argument more intuitive, but the loss of $\alpha/4$ should be viewed, more generally, as reflecting the decline in product diversity.) These two elements (a social gain of F_2 and a social loss of $\alpha/4$) imply

[11] This approach is adopted by Williamson [1977] ("predatory pricing should [...] be evaluated in efficiency terms") and Ordover and Saloner [1989] ("we shall term *anticompetitive* or *predatory* those aggressive and exclusionary business strategies that, when deployed, have the effect of lowering [...] social welfare.")

RESULT 2. *Firm 2's exclusion increases social welfare if and only if* $\alpha < 4F_2$.

Comparing Results 1 and 2 reveals that if firm 1 finds it profitable to exclude firm 2 even in the absence of any possibility to raise prices later, then firm 2's exclusion increases social welfare. This is simply because the profitability of such an action requires α to be smaller than $3.6F_2$, and therefore smaller than $4F_2$, which implies that firm 2's exclusion is socially beneficial (its effect on consumers' surplus, however, is ambiguous[12]).

In other words, for firm 2's exclusion to be detrimental to social welfare, it must be the case that its profitability, for firm 1, relies on the possibility to subsequently raise its price. This means that all actions labeled as predatory according to D1 or D3 but not according to D2 in fact cause social welfare to rise, so that D1 and D3 are too broad from the point of view of social welfare maximization (they view too many actions as predatory). The narrower definition D2 is enough to deter socially harmful exclusionary pricing (since exclusionary prices are predatory according to D2 as soon as $\alpha > 3.6F_2$, even D2 may label as predatory some exclusionary prices which in fact cause social welfare to rise, if $3.6F_2 < \alpha < 4F_2$).

Results 1 and 2 lead us, therefore, to choose D2 as the best definition. Unfortunately, the argument is not as robust as one might wish: the claim that profitable exclusionary pricing not followed by a later price increase necessarily increases social welfare is a consequence of the fact that private profitability requires α to be smaller than $3.6F_2$, while the effect on welfare is positive as long as α is smaller than $4F_2$. These thresholds happen to be ranked in the "right" way (3.6 is smaller than 4), but there is no "deep" reason for this, and another model might not yield this convenient conclusion. The most that can safely be argued is that this model, the simplest possible one for the analysis of exclusionary pricing, lends support to the choice of definition D2 over D1 or D3[13]. It also corresponds to the general

[12] A quick calculation shows that consumers' surplus rises only if $\alpha > \frac{128}{49}F_2 = 2.6F_2$. Since 2<2.6<3.6, profitable exclusionary pricing not followed by a later price increase may benefit or harm consumers. The reason is that they gain from lower prices, but lose from the decline in product diversity. In the limit case where α is very close to $2F_2$ and firm 2's profits are very low, its exclusion requires only that firm 1 decrease its price by very little, so consumers' gain from lower prices is very small, and the decline in product diversity is the dominant effect, making consumers worse off.

[13] Another drawback of D3 is that if firms produce different goods, efficiency comparisons across firms make little sense.

spirit of competition policy, according to which the law should deter firms from deliberately seeking market power. The coincidence between general principles and the theoretical results presented above allows us to choose D2 as the best definition.

Is Nash equilibrium the right benchmark?

Much of the literature stresses that the benchmark against which possible predatory outcomes should be assessed is the competitive equilibrium[14]. The reason for this caveat is that a firm should not be considered guilty if it reduces its price in a way that causes its short-run profits to fall relative to an initial situation where profits were high as a result of illegal collusive behavior.

But what exactly is the competitive outcome? The most natural answer is probably to consider the Nash equilibrium, which is a satisfactory concept because it describes non-cooperative behavior in a symmetric way. Some authors went as far as quantitatively estimating the Nash equilibria in actual cases, such as Dodgson et al. [1993], who investigated the "bus war" which took place in the U.K. in 1986 (they modeled the case as one of quantity rather than price competition, but this is irrelevant to the discussion of whether the Nash equilibrium is the right benchmark).

But this warning to distinguish between Nash equilibria and collusive outcomes may lead us to overlook a third possibility, that of Stackelberg equilibria, which can convincingly be defended as the right benchmark. A Stackelberg equilibrium is the outcome that arises if one of the firms (usually called the "leader") chooses its actions taking into account its impact on the other firm's (the "follower's") action, while the follower simply chooses its best response to the leader's action. In a Nash equilibrium, each firm chooses the price which maximizes its profits given the other firm's price. In a Stackelberg equilibrium, only the follower does so, and the leader chooses the price that maximizes its profit given the impact its price will have on the follower's price decision: the Stackelberg leader behaves more strategically than do firms in a Nash equilibrium.

Many definitions of what constitutes predatory behavior (such as D1 and

[14]For example, according to Ordover and Willig [1981], "the sacrifice of profit must be assessed with reference to "competitive circumstances". Sacrifice should not be inferred if the incumbent avoids a cartel-like response that yields greater profits both for him and for his rival".

D2 above) rely on comparing the consequences of the alleged predatory action with those of other possible actions. In order to determine whether firm 1's price is predatory, one should, according to definition D1, compare the profit it yields to firm 1 once its exclusionary effect is taken into account, the profit the same action would yield if it had no exclusionary effect, and the maximal profit firm 1 could earn if it chose the profit-maximizing price conditional on not excluding another firm.

But how should the profit yielded by a given action be defined? Considering the profit firm 1 would earn if firm 2 responded optimally to any of firm 1's actions appears as an obvious answer. But then, the maximal profit firm 1 can earn conditional on not excluding firm 2 is its profit in the "non-exclusionary" Stackelberg equilibrium where it is the leader, rather than the Nash equilibrium profit.

Calculating this profit is easy, but not necessary for our argument[15]. The only important point is that the Stackelberg outcome yields the leader (firm 1) profits at least as large as in the Nash equilibrium. This is simply because if firm 1 is a Stackelberg leader, it could have chosen the equilibrium price p_1^*, which would have led firm 2 to choose the price $P_2(p_1^*) = p_2^*$, leading both firms to earn their equilibrium profits. So the Stackelberg leader's profit is at least as large as its Nash equilibrium profit (it is in fact larger as indicated in the footnote above)[16].

This almost tautological remark allows us to apply Results 1 and 2 in order to compare various definitions of predation in the case where the Stackelberg outcome is considered a better benchmark than the Nash equilibrium. Consider a price which is predatory according to D1 or D3, but not according to D2, where predation is now defined with respect to the Stackelberg benchmark. This means that, taking its exclusionary effects into account, and assuming it cannot be raised thereafter, this price yields firm 1 a greater profit than the non exclusionary Stackelberg outcome where it is the leader (I am again making the weak assumption than even under definition D3, the action under scrutiny must maximize profits). But since firm 1's profit

[15] Firm 1's price when it is a Stackelberg leader maximizes $\pi_1(p_1, P_2(p_1))$, yielding $p_1^{Stack} = c + \frac{3}{2}\alpha$ and $\pi_1^{Stack} = \pi_1(p_1^{Stack}, P_2(p_1^{Stack})) = \frac{9}{16}\alpha - F_1$.

[16] A Stackelberg equilibrium in a game of price competition yields the follower greater profits than the Nash equilibrium, because in order to induce the follower to raise its price, the leader raises its price, which benefits the follower. The opposite is true if firms compete in quantities: in order to induce the follower to reduce its output, the leader raises its output, which harms the follower.

is greater in the Stackelberg equilibrium than in the Nash equilibrium, the price under scrutiny is also predatory according to D1 and D3 but not according to D2 when these definitions are understood with a Nash benchmark. Therefore, results 1 and 2 still apply, and such an exclusionary price has a positive impact on welfare[17].

To sum up, the fact that a firm earns greater profits as a Stackelberg leader than it would in a Nash equilibrium only strengthens the conclusions reached above. Irrespective of which benchmark (Nash or Stackelberg equilibrium) the various definitions refer to, it remains true that D1 and D3 are too broad, and that the narrower definition D2 suffices to label as predatory all exclusionary pricing practices which are detrimental to social welfare.

IV - ASSESSMENT OF VARIOUS LEGAL CRITERIA

Areeda and Turner's price-cost comparisons

The model can help us to assess various criteria[18]. Let us start with the most famous of them, first proposed by Areeda and Turner [1975], and then extensively used by courts. It consists in comparing the alleged predator's price with its costs. Which cost should be considered has been the subject of somewhat esoteric discussions (the last word being probably Baumol, 1996). For the purpose of this analysis, the only costs which could be considered are the marginal cost (equal to c), and the average variable cost, equal to the total cost divided by output (total and variable costs coincide because the fixed cost is not sunk, and they also coincide with the average avoidable cost, advocated by Baumol as superior). These two cost thresholds are considered hereafter.

Assume first that, according to the prevailing criterion, a price is precluded if it lies below firm 1's average total cost as long as firm 2 remains in the market. The exact interpretation of this sentence requires one to know

[17]One can show that a permanent exclusionary price cut is profitable for a Stackelberg leader if $\alpha < \frac{2048}{625}F_2 \approx 3.3F_2$. It necessarily increases welfare because 3.3<4.

[18]On the evolution of the criteria used by courts (a topic beyond this paper's scope), see, e.g., Klevorick [1993] and Bolton et al. [2000]. For our purposes, the only relevant fact is the uncertain and volatile character of legal practice: it implies that all the criteria discussed hereafter can be expected to be used with a reasonable probability, and that discussing their merits, one by one, is useful.

how firm 2 reacts to firm 1's price. Let us assume that it chooses its best response, conditional on not exiting[19]. The implicit scenario is one where firm 2's fixed cost is sunk in the short-run (see above), so that its best response is to stay in the market in the short-run, and to exit in the long-run (firm 2 will exit at the time when it must decide whether to pay the fixed cost again or not).

Assume that firm 1's price is lower than its average total cost as long as firm 2 does not exit. What does this tell us about firm 1's price in terms of definitions D1, D2 and D3, and about the consequences of firm 1's actions on social welfare? Since firm 1 makes losses as long as firm 2 is in the market, while these losses could be avoided, for example, by charging the Nash equilibrium price (A1 is still assumed to hold, so this price would generate positive profits), the only possible explanation for charging this price is that firm 1 is trying to drive firm 2 out of the market. Therefore, a price below average total cost, together with the assumption that firm 1 is maximizing its long-run profits (this is simply a rationality assumption) is indicative of predatory behavior in the sense of D1.

However, the correspondence between the Areeda-Turner criterion and definitions D1, D2 and D3 is very imperfect. If firm 1 chooses an exclusionary strategy, then it is optimal to choose the highest exclusionary price in order to minimize losses (or to maximize profits) during the predation period. If in addition firm 1 cannot raise its price after firm 2's exit, this also maximizes post-predation profits. This highest exclusionary price is p_1^{pred} as determined in (2) above, defined by the equation $\pi_2(p_1^{pred}) = 0$. During the predation period, firm 2's price is equal to its best response $P_2(p_1^{pred})$, and firm 1's profit is $\pi_1(p_1^{pred}, P_2(p_1^{pred}))$, which, after a few lines of algebra, can be shown to be equal to

$$AT = \alpha \left[\left(\frac{8F_2}{\alpha} \right)^{1/2} - 1 \right] \left[1 - \left(\frac{F_2}{2\alpha} \right)^{1/2} \right] - F_1.$$

p_1^{pred} is below firm 1's average total cost if firm 1's profit is negative, i.e. if $AT < 0$.

Apart from the fact that a price below average total cost is chosen by a rational firm only if it leads to a competitor's exclusion, very little can be

[19] I do not consider the possibility that firm 2 chooses a price with the goal of affecting firm 1's average total cost (through the effect on the demand facing both firms) and hence the outcome of the judicial process.

inferred from the sign of AT, which bears little relationship to any of the definitions D1, D2, D3. Let us focus on D2, which was found to be the best of the three definitions. As was shown in Result 1, exclusionary pricing is predatory according to D2 if $\frac{\alpha}{F_2} > \frac{32}{9} \approx 3.6$ (the threshold is $\frac{2048}{625} \approx 3.3$ if the benchmark is the Stackelberg rather than the Nash equilibrium). Also, exclusionary pricing is socially harmful if $\frac{\alpha}{F_2} > 4$ (from Result 2). But the sign of $\frac{\alpha}{F_2} - \frac{32}{9}$, or of $\frac{\alpha}{F_2} - 4$, is unrelated to the sign of AT. Indeed, one can easily choose values of $\frac{F_2}{\alpha}$ and $\frac{F_1}{\alpha}$ leading to all possible combinations of signs for AT and $\frac{\alpha}{F_2} - \frac{32}{9}$, or for AT and $\frac{\alpha}{F_2} - 4$. Therefore, a price can be above firm 1's average total cost while being predatory according to the narrow definition D2, and, more strongly, while causing social welfare to decline. Conversely, a price can fall below average total cost while not being predatory according to D2, and therefore while causing social welfare to rise.

This last statement may seem surprising. If price is below average cost, how could a firm recoup its losses if not by later raising its price? The answer is that after firm 2 is driven out of the market, firm 1's demand rises (keeping its price unchanged), and this causes the average cost to fall because the fixed cost is spread over more units of the good. The decline of the average cost may be enough to induce positive profits after firm 2's exclusion (and even profits above their pre-exclusion level) without any need for firm 1 to raise its price.

Therefore, precluding prices below average total cost may lead to both kinds of errors: some exclusionary prices which reduce social welfare might be allowed, while other might be precluded in spite of being socially beneficial. Similarly, prices which are predatory according to D2 might be allowed, while other which are not might be precluded.

The reason is simply that firm 1's average total cost depends (among other things) on its fixed cost, which is completely unrelated to the comparison of the profitability for firm 1 of various actions (firm 1 pays its fixed cost anyway), and to the social desirability of firm 2's exclusion[20].

The drawbacks of the Areeda-Turner criterion appear maybe more clearly in the case where both firms are equally efficient, i.e. where $F_1 = F_2 = F$. Solving a second-degree equation reveals that $AT > 0$ if $2\alpha < F < 4.5\alpha$. Therefore, if $3.6\alpha < F < 4.5\alpha$, an exclusionary price cut is profitable only if the price can rise later, but it is allowed under the Areeda-Turner rule.

[20] Phlips [1996] makes a related point when he argues that price-cost comparisons should focus less on the alleged predator's costs, and more on the alleged prey's.

The result can be extended by continuity to the case where F_1 is slightly larger than F_2: exclusion of a more efficient rival through a price cut which is profitable only if it is later reversed may not be deterred by implementing the Areeda-Turner rule. Conversely, if $\frac{16}{9}\alpha < F < 2\alpha$, then a a permanent exclusionary price cut is profitable for a Stackelberg leader and causes welfare to rise, but it would be precluded under the Areeda-Turner rule.

What about comparing price and marginal cost? First, under the assumption of constant marginal costs, a price below marginal cost can not become profitable even after inducing a rival's exclusion unless it is followed by a price increase, which means that it is predatory under definition D2 (assuming firms are rational). Also, firm 1's largest exclusionary price, p_1^{pred}, as determined in (2), is smaller than the marginal cost c if and only if $\alpha > 8F_2$. But we know that if $\alpha > 4F_2$, exclusion is detrimental to social welfare. Therefore, the Areeda-Turner test with a marginal cost benchmark is too permissive: it does not deter all socially detrimental exclusionary practices, nor does it deter all practices which are predatory according to the narrow definition D2.

To summarize, this examination of two versions of the Areeda-Turner test leads us, at best, to a mixed appraisal. Of course, price-cost comparisons are useful, because the three definitions proposed above are indirectly related to firms' costs, through the reference to the profitability of various actions, or to efficiency comparisons across firms. In particular, as was just shown, proof that a price falls below marginal cost should be sufficient, but not necessary, to have it labeled as predatory. However, comparisons between price and average total cost (which, here, coincides with average avoidable cost) are very difficult to interpret, because they bear no close relationship to any reasonable definition of predation, or to a welfare analysis. This point is quite general, and unrelated to the specifics of the model[21].

While they may be very useful, price-cost comparisons should not, therefore, be part of the definition of predatory pricing, and should not be given precedence over other approaches in assessing predation claims[22]. In the light of this analysis, the Supreme Court's statement that "predatory pricing may be defined as pricing below an appropriate measure of cost for the purpose

[21] Scherer's [1976a] critique of the Areeda-Turner rule relies on related arguments. See also Areeda and Turner's [1976] reply, and Scherer's [1976b] reply to the reply.

[22] Notice the difference between our criticism of price-cost comparisons and the usual "pragmatic" criticism, which is based on the difficulty of measuring costs accurately and quickly (Joskow and Klevorick, 1979).

of eliminating competitors in the short run and reducing competition in the long run" appears highly unsatisfactory[23].

Intent

Exclusionary intent may prove that an exclusionary price is predatory according to the broad definition D1, but not necessarily according to D3 or to the definition found to be best, D2. This is simply because exclusion can be profitable without any subsequent price rise, and without the firm driven out of the market as a result of the exclusionary price being more or equally efficient than the alleged predator. Therefore, even if intent could be properly assessed, it would not be a good criterion, because it would lead to preclude all price reductions which are predatory according to D1, which, as we saw above, is a too broad definition, leading to a too harsh policy[24].

Joskow and Klevorick's two-tier system

Joskow and Klevorick [1979] advocate a two-tier system. In the first stage, market structure is investigated. Only if it is found to be characterized by significant barriers to entry, which make it possible for the alleged predator to raise prices later, does the second stage take place, where the alleged predator's actual behavior is examined, using price-cost comparisons or proof of intent as possible elements, among other, to prove predation.

This method was justified, first, by the impracticalities of price-cost comparisons, and by the need to screen cases in the first stage before engaging into complicated cost assessments in the second stage, and, second, by Joskow and Klevorick's definition of predation, requiring a price rise in the post-predation phase (they adopt definition D2).

[23] The overall context proves that the Court's statement almost had the status of a theoretical definition, because the decision in which it was issued (*Cargill, Inc.* v. *Monfort of Colorado, Inc.*, 479 U.S. 104, 1986; quoted in Klevorick, 1993) stressed the practical insufficiency of price-cost comparisons for law enforcement, and advocated as more pragmatic an approach relying heavily on a study of market structure.

[24] The legal literature sometimes criticizes courts' occasional attempts to ascertain a firm's exclusionary intent, arguing that it is impossible to establish intent objectively enough. The criticism made here is stronger: even if exclusionary intent could be proved objectively, it should not suffice to make a price cut illegal. However, convincing evidence that a price cut was motivated by a goal other than excluding a competitor should be sufficient to exonerate an alleged predator.

Given our earlier conclusion that D2 is the best of the definitions considered above and our skepticism regarding price-cost comparisons, the analysis developed so far in this paper lends support to Joskow and Klevorick's two-tier system. There are, nevertheless, two caveats.

First, although the existence of barriers to entry implies that the alleged predator's price will rise after its competitor is driven out of the market, it does not imply that a subsequent price rise is *necessary* to make exclusion profitable. But we showed that, within our very specific model, if a subsequent price rise is not necessary to make exclusion profitable, then exclusion is socially beneficial. The existence of barriers to entry or other elements of market structure may be indicative of the *possibility* of later price increases, while a welfare assessment (or, more precisely, an assessment of whether a price cut is predatory according to D2) depends on their *necessity*. However, this remark loses some relevance if antitrust policy aims to protect consumers rather than promoting overall social welfare, because high prices harm consumers even if they do not affect overall welfare, and the fact that market structure makes such price rises possible, even if they were not necessary for predation to be profitable, should matter. In addition, post-predation price increases would be socially harmful if the unit demand assumption were dropped: in the model developed above, the only social cost from exclusion is the decline in product diversity, while monopolistic prices do not harm efficiency, because demand is constant at 1. If instead the demand function were downward-sloping, then post-predation price increases would harm welfare by inducing a too low output level. Finally, assessing the necessity of subsequent price rises to make predation profitable, rather than their mere possibility, would require information about firms' costs, which is usually much more difficult to gather than information about the general characteristics of an industry. Given all these qualifications, the best is probably to overlook the distinction between necessity and possibility, and to adhere to Joskow and Klevorick's view.

The second caveat is more important. Recent economic theory has identified barriers to entry which do not result from "objective" elements such as sunk costs, but from imperfections in capital markets ("financial predation"), or from subtle strategic considerations, such as the possibility for a predator to build a reputation for "toughness". All these possibilities should be considered in the first stage, in addition to standard market structure analysis. Although this paper has nothing new to contribute on this issue, it is central in any discussion of predation (on this issue, see Bolton et al.'s

[2000] proposals).

Baumol's quasi-permanence rule

Baumol [1979] proposed a rule of "quasi-permanence of price reductions". It raises a number of practical questions - how can it be enforced if its implementation requires one to take into account cost and demand shocks, which are hardly observable, or even seasonal fluctuations? But, since it leads, if properly implemented, to the prevention of all exclusionary price cuts which are profitable only to the extent that they can be reversed after they induced a rival's exclusion, this rule would deter prices which are predatory according to D2, found above to be the best definition.

Baumol's rule also has another positive consequence: in cases of "innocent predation", where the presence of barriers to entry allows a firm to raise price after excluding a rival, although such a price rise was not necessary to make the initial exclusionary price cut profitable, this rule does not prevent the "innocent" price cut from taking place, but it constrains post-exclusion behavior in a socially beneficial way.

Therefore, in cases where price competition (rather than quantity competition) is the right model, and where implementation problems can be surmounted, Baumol's quasi-permanence rule seems justified.

V - CONCLUDING REMARKS

Price or quantity competition?

Depending on the characteristics of the industry under consideration, the strategic interaction between firms must be modelled by describing firms either as price-setters (as in the model considered above), or as quantity-setters. As is well known (see, e.g., Tirole, 1988), a model where firms set quantities can be interpreted as a reduced form for a situation where firms first set capacities, and then compete in prices. The legal literature and practice resorts to both kinds of analysis. On the one hand, predation is often discussed in terms of firms deciding to cut prices (with exclusionary purposes) and to subsequently raise them. On the other hand, in markets where prices can be assumed to adjust more quickly than quantities, predatory behavior is

described in terms of the predator increasing its output (rather than cutting its price), and the later recoupment is viewed in terms of output reduction rather than of price increases[25].

For example, Dodgson et al. [1993] modelled the 1986 "bus war" in the U.K. by assuming transportation companies to set quantities (i.e. the number and frequency of buses serving a particular route), while prices instantaneous adjusted to clear the market on each route. Similarly, the United States Department of Transportation's "enforcement policy regarding unfair exclusionary conduct in the air transportation industry" relies on the idea that airlines' decide quantities (i.e. the frequency with which they serve a particular route) while prices quickly adjust to clear markets[26].

Identifying whether the right model is price competition or quantity competition matters a lot, because these models lead to very different outcomes. For example, in contrast to price competition, quantity competition between firms producing the same good induces prices strictly above marginal costs, making it possible for firms facing a fixed cost and constant marginal costs to earn positive profits in the Nash equilibrium.

How does the need to distinguish between these two forms of competition affect the analysis conducted in this paper? The claim that several seemingly identical definitions are in fact different and the criticism of the Areeda-Turner test both remain valid if firms compete in quantities rather than in prices. Indeed, the argument that a price cut inducing a rival's exclusion may be profitable without requiring a subsequent raise has a counterpart in terms of quantities: an exclusionary quantity increase which would not be profitable if it did not induce exit may be profitable without requiring a subsequent output decrease, because the rival's exclusion causes the price to rise even if the alleged predator keeps its output level unchanged. Similarly, an output expansion causing the price to fall below average cost as long as the rival does not exit from the market must not necessarily be reversed after

[25]Whether recoupment is described in terms of price-setting or quantity-setting is irrelevant if only one firm remains, because a monopolist simply picks a point within a set of possible price-quantity pairs. The difference matters only if there are at least two firms. However, since the assessment of predation claims often involves the question of the post-exclusion reversal of an exclusionary action, whether the post-exclusion action is viewed as a quantity choice or a price choice may have very different implications (see below).

[26]See *Statement of the Department of Transportation's Enforcement Policy Regarding Unfair Exclusionary Conduct in the Air Transportation Industry*, D.O.T. Office of the Secretary, Docket No. OST-98-3713, Notice 98-16.

the rival's exclusion in order to be profitable.

Nevertheless, the possible uncertainty regarding which model (price or quantity competition) is right can make it difficult to implement a definition of predation such as "an action is predatory if it is not the most profitable action unless its exclusionary effects and the possibility to later reverse it are taken into account" (D2). If courts find it hard to tell whether the action to consider is the choice of a price or the choice of a quantity, implementation problems arise. Assume for example that strategic decisions are wrongly believed to be about prices, when they are in fact about quantities (say, because it takes time to adjust capacities, or because the available technology prevents a firm from producing above a given level). If a firm's decision to permanently increase capacity and output drives a rival out of the market, the post-exclusion price is higher than immediately before the rival's exit (because total output falls by the rival's pre-exit output level), and a court may wrongly interpret the price increase as proof that the initial price cut was reversed after the rival's exit, when it should instead consider the permanence of the output increase. Therefore, Baumol's rule of quasi-permanence of price reductions may lead to mistaken decisions if applied to cases where quantity competition is the right model.

For specific industries, the nature of competition can be described with enough confidence, and the general definition stated above in terms of "predatory actions" can then be made more precise. For example, the rules defining "unfair exclusionary conduct" in air transportation in the United States (see above) constrain airlines' choices of quantities (i.e. frequencies) rather than prices, while the rules applying to cable TV constrain firms' pricing decisions[27].

Since assessing whether price or quantity competition is the right model may be difficult, criteria which apply equally to both situations would be valuable. I argued above that Baumol's rule does not have this desirable property because it makes sense in a world of price competition but not of quantity competition, and the converse can be said of Williamson's output restriction rule. These qualifications should be kept in mind when applying either of these rules. In contrast, the first tier of Joskow and Klevorick's

[27]The rules governing cable television since the 1992 Cable Act limit the possibility of geographic discrimination, by preventing rate cuts from occuring only in areas threatened by competitors. Such limitations are close in spirit to Baumol's rule of "quasi-permanence of price reductions" because they cause price cuts to be more extensive (in space or in time) than would be necessary for exclusionary purposes.

two-tier system, which consists in assessing the existence and magnitude of barriers to entry (understood broadly enough, as discussed in section IV), is compatible with agnosticism regarding the nature of competition, and this should be seen as one more argument in favor of this system.

In defense of the rule of reason

Several conclusions can be derived from the simple model of price competition developed in this paper, and from the discussion of the alternative case of quantity competition. Even without taking into account any of the elements which make the analysis of real-world predation claims complex (such as the role of innovation, product introduction, learning by doing) or any of the sophisticated theoretical explanations of predation (such as those relying on financial market imperfections or on various kinds of asymmetric information), the simplest possible analysis casts doubt on much received wisdom: price-cost comparisons bear little relationship to any reasonable definition of predation, rules restricting post-exclusion price increases or post-exclusion output decreases may not work as well as their advocates argued if price competition is mistaken for quantity competition, or vice-versa. Even proof of exclusionary intent should not be given too much importance, because it does not necessarily indicate intent to subsequently raise prices.

This skeptical appraisal of various per-se rules provides additional support for a two-tier system such as the one proposed by Joskow and Klevorick [1979], once it is augmented to take into account the recent findings of economic theory (Bolton et al., 2000). But is also implies that no single rule, however carefully designed, can be applied to all predation claims, and that the rule of reason should often be used. This, in turn, makes it very important to agree on a clear definition of predation. Since several definitions often held as equivalent by courts and by the legal literature are in fact different (as shown in section III), this task is by no means easy, although defining as predatory any action which is not the most profitable one unless its exclusionary effects *and* the possibility to later reverse it are taken into account should win enough support (leaving open, however, the question of which "fair competition" benchmark should be considered).

Besides the criticisms of existing definitions and criteria of predatory pricing, another message of this paper is that the distance between the economic literature and the largely informal legal debates about predation may be excessive. Without necessarily delving into esoteric theory, borrowing some of

its logical rigor would help legal discussions to achieve greater clarity.

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